By this method of developing platinotype paper, many negatives which have been discarded on account of the dim, flat, non-contrasty results which they yield, in the hands of one possessing a little artistic skill, produce snappy, animated pictures. On the other hand, from the sharp and hard negative, soft, sketchy effects may be secured.

There are required for this process: Some glass jars; some soft brushes, varying from the fine spotter and the Japanese brush to the 1½-inch duster, and several pieces of special blotting paper.

Manipulation.—Print the paper a trifle deeper than for the ordinary method of developing. Place the print face up on a piece of clean glass (should the print curl so that it is unmanageable, moisten the glass with glycerine), and, with the broad camel's-hair brush, thinly coat the entire print with pure glycerine, blotting same off in 3 or 4 seconds; then recoat more thickly such portions as are desired especially restrained, or the details partly or entirely eliminated. Now brush or paint such portion of the print as is first desired with solution of 1 part glycerine and 4 parts normal developer, blotting the portion being developed from time to time to avoid developing too far. Full strength developer (without glycerine) is employed where a pronounced or deep shade is wanted.

When any part of the print has reached the full development desired, blot that portion carefully with the blotter and coat with pure glycerine.

A brown effect may be obtained by using saturated solution of mercury in the developer (1 part mercury to 8 parts developer). By the use of diluted mercury the "flesh tones" are produced in portraits, etc.

When print has reached complete development, place in hydrochloric (muriatic) acid and wash as usual.

Eastman's Sepia Paper.—This paper is about 3 times as rapid as blue paper. It should be under rather than over printed, and is developed by washing in plain water. After 2 or 3 changes of water fix 5 minutes in a solution of hypo (1½ grains to the ounce of water), and afterwards wash thoroughly.

Short fixing gives red tones. Longer fixing produces a brown tone.

Development of Platinum Prints.—In the development of platinotype prints by the hot bath process, distinctly warmer tones are obtained by using a bath which has been several times heated, colder blacks resulting from the use of a freshly prepared solution, and colder tones still if the developing solution be faintly acidified. The repeated heating of the solution of the neutral salt apparently has the effect of rendering the bath slightly alkaline by the conversion of a minute proportion of the oxalate into potassium carbonate. If this be the case, it allows a little latitude in choice of tone which may be useful. Some photographers recommend the use of potassium phosphate with the neutral oxalate, stating that the solution should be rendered acid by the addition of a small proportion of oxalic acid. When the potassium phosphate was first recommended for this purpose, probably the acid salt, KH_2PO_4, was intended, by the use of which cold steely black tones were obtained. The use of the oxalic acid with the ordinary phosphate K_2HPO_4, is probably intended to produce the same result.

THE CARBON PROCESS.

The paper used is coated on one surface with a mixture of gelatin and some pigment (the color of which depends upon the color the required print is to be), and then allowed to dry. When required for printing it is sensitized by floating upon a solution of bichromate of potassium, and then again drying, in the dark this time. The process is based upon the action of light upon this film of chromatized gelatin; wherever the light reaches, the gelatin is rendered insoluble, even in hot water.

The paper is exposed in the usual way. But as the appearance of the paper before and after printing is precisely the same, it is impossible to tell when it is printed by examining the print. This is usually accomplished by exposing a piece of gelatino-chloride paper under a negative of about the same density, and placing it alongside of the carbon print. When the gelatino-chloride paper is printed, the carbon will be finished. The paper is then removed from the printing frame and immersed in cold water, which removes a great deal of the bichromate of potassium, and also makes the print lie out flat. It is then floated on to what is known as a support, and pressed firmly upon it, face downwards, and allowed to remain for 5 or 10 minutes. Then the support, together with the print, is placed in hot water for a short time, and when the gelatin commences to ooze out at the edges the print is removed by stripping from the support, this process leaving the greater quantity of the gelatin and pigment

upon the support. The gelatin and pigment are then treated with hot water by running the hot water over the face of the support by means of a sponge. This removes the soluble gelatin, and leaves the gelatin, together with the pigment it contains, which was acted upon by light; this then constitutes the picture.

The reason for transferring the gelatin film is quite apparent, since the greater portion of the unacted-upon gelatin will be at the back of the film, and in order to get at it to remove it, it is necessary to transfer it to a support. In this condition the print can be dried and mounted, but on consideration it will be seen that the picture is in a reversed position, that is to say, that the right-hand side of the original has become the left, and vice versa.

If the picture be finished in this condition, it is said to have been done by the single transfer method. In some instances this reversal would be of no consequence, such as some portraits, but with views which are known this would never do. In order to remedy this state of affairs, the picture is transferred once more, by pressing, while wet, upon another support, and allowed to dry upon it; when separated, the picture remains upon the latter support, and is in its right position. This is what is known as the double transfer method. When the double transfer method is used, the first support consists of a specially prepared support, which has been waxed in order to prevent the pictures from adhering permanently to it; this is then known as a temporary support. The paper upon which the print is finally received is prepared with a coating of gelatin, and is known as the final support.

LANTERN SLIDES.

The making of a good slide begins with the making of the negative, the operations in both cases being closely allied, and he who has mastered the first, which is the corner stone to all successful results in any branch of photography, may well be expected to be able to make a good lantern slide. A slide is judged not by what it appears to be when held in the hand, but by its appearance when magnified two to five thousand times on the screen, where a small defect in the slide will show up as a gross fault. Patience and cleanliness are absolutely necessary. The greatest caution should be observed to keep the lantern plates free from dust, both before and after exposure and development, for small pinholes and dust spots, hardly noticeable on the slide, assume huge proportions on the screen and detract materially from the slide's beauty.

The high lights in a slide should, in rare cases only, be represented by clear glass, and the shadows should always be transparent, even in the deepest part. The balance between these extremes should be a delicate gradation of tone from one to the other. The contrast between the strongest high light and the deepest shadow should be enough to give brilliancy without hardness and delicacy or softness without being flat. This is controlled also, to some extent, by the subject summer sunshine requiring a more vigorous rendering than hazy autumn effects, and herein each individual must decide for himself what is most necessary to give the correct portrayal of the subject. It is a good idea to procure a slide, as near technically perfect as possible, from some slide-making friend, or dealer, to use it as a standard, and to make slide after slide from the same negative until a satisfactory result is reached.

A black tone of good quality is usually satisfactory for most slides, but it is very agreeable to see interspersed a variety of tone, and beautiful slides can be made, where the subject warrants, in blue, brown, purple, and even red and green, by varying the exposure and development and by using gold or uranium toning baths and other solutions for that purpose, the formulas and materials for which are easily obtainable from the magazines and from stock dealers, respectively.

It must be understood, however, that these toning solutions generally act as intensifiers, and that if toning is contemplated, it should be borne in mind at the time of developing the slide, so that it may not finally appear too dense. Toning will improve otherwise weak slides, but will not help under-exposed ones, as its tendency will be in such case to increase the contrast, which in such slides is already too great. Another method of getting a fine quality of slides is to make rather strong exposures to over-develop, and then to reduce with persulphate of ammonium.

The popular methods of making the exposure are: First, by contact in the printing frame, just as prints are made on velox or other developing paper, provided the subject on the negative is of the right size for a lantern slide; and the other and better method is the camera

method, by which the subject of any negative, large or small, or any part thereof, can be reduced or enlarged, and thus brought to the proper size desired for the slide. This is quite a knack, and should be considered and studied by the slide maker very carefully.

Hard and inflexible rules cannot be laid down in this relation. Portrait studies of bust or three-fourths figures or baby figures need not be made for a larger opening than 1½ by 2 inches, and often appear to good advantage if made quite a bit smaller. Figure or group compositions, with considerable background or accessories, may, of course, have a larger opening to suit the particular circumstances. Monuments, tall buildings, and the like should have the benefit of the whole height of mat opening of 2¾ inches, and should be made of a size to fill it out properly, providing, however, for sufficient foreground and a proper sky line. Landscapes and marine views generally can be made to fill out the full length of mat opening, which, however, should not exceed 2⅞ inches, and may be of any height to suit the subject, up to 2¾ inches.

The subject should be well centered on the plate and the part intended to be shown as the picture should be well within the size of the mat opening decided upon, so that with a slight variation of the placing of the mat no part of the picture will be cut off by the carrier in the stereopticon. The horizon line in a landscape, and more particularly in a marine view, should always be in proper position, either below or above the center line of the slide, as may suit the subject, but should never divide the picture in the middle and should not appear to be running either up or down hill. And the vertical lines in the pictures should not be leaning, but should run parallel with the side lines of the mat; this refers especially to the vertical lines in architecture, except, however, the Tower of Pisa and kindred subjects, which should in every case be shown with their natural inclinations.

As to time of exposure, very little can be said. That varies with the different makes of plates, with the quality of the light, and the nature and density of each individual negative. Therefore every one must be a judge unto himself and make as good a guess as he can for the first trial from each negative and gauge further exposures from the results thus obtained; but this much may be said, that a negative strong in contrast should be given a long exposure, close to the light, if artificial light is used, or in strong daylight, and developed with a weak or very much diluted developer to make a soft slide with full tone values. And a flat, weak negative will yield better results if exposed farther from the light or to a weaker light, and developed by a normal or more aggressive developer. Over exposure and under exposure show the same results in slide plates as in negative plates, and the treatment should be similar in both kinds of plates except that, perhaps, in cases of under exposure of slide plates, the better plan would be to cast them aside and make them over, as very little can be done with them. For getting bright and clear effects it is now well understood that better and more satisfactory results are obtained by backing the slide plates as well as by backing negative plates. This is accomplished by coating the back or glass side of the plate with the following mixture:

Gum arabic.....	½ ounce
Caramel.....	1 ounce
Burnt sienna.....	2 ounces
Alcohol.....	2 ounces

Mix and apply with small sponge or wad of absorbent cotton.

It should coat thin and smooth and dry hard enough so it will not rub off when handled. If the plates are put into a light-proof grooved box as fast as backed, they can be used about half an hour after being coated. Before developing, this backing should be removed; this is best done by first wetting the film side of the plate under the tap, which will prevent staining it, and then letting the water run on the backing, and, with a little rubbing, it will disappear in a few moments, when development may proceed. Other preparations for this purpose, ready for use, may be found at the stock houses. The mat should be carefully selected or cut of a size and shape to show up the subject to best advantage, and should cover everything not wanted in the picture. The opening should not exceed 2¾ x 2⅞ inches in any case, and must not be ragged or fuzzy, but clean cut and symmetrical. The lines of the opening of square mats should be parallel with the outside lines of the plate. Oval, or round, or other variously shaped mats, should be used sparingly, and in special cases only where the nature of the subject will warrant their use.

Statuary shows up to best advantage when the background is blocked out.

This is easily done with a small camel's-hair artist's brush and opaque or india ink, in a retouching frame, a good eye and a steady hand being the only additional requirements. This treatment may also be applied to some flower studies and other botanical subjects.

Binding may be performed with the aid of a stationer's spring clamp, such as is used for holding papers together, and can be purchased for 10 cents. Cut the binding strips the length of the sides and ends of the slide, and gum them on separately, rubbing them firmly in contact with the glass with a piece of cloth or an old handkerchief, which might be kept handy for that purpose, so that the binding may not loosen or peel off after the slides are handled but half a dozen times. Before storing the slides away for future use they should be properly labeled and named. The name label should be affixed on the right end of the face of the slide as you look at it in its proper position, and should contain the maker's name and the title of the slide. The thumb label should be affixed to the lower left-hand corner of the face of the slide, and may show the number of the slide.

HOW TO UTILIZE WASTE MATERIAL.

Undoubtedly spoiled negatives form the greatest waste. The uses to which a ruined negative may be put are manifold. Cut down to 3¼ inches square and the films cleaned off, they make excellent cover glasses for lantern slides. Another use for them in the same popular branch of photography is the following: If, during development, you see that your negative is spoiled through uneven density, over exposure, or what not, expose it to the light and allow it to blacken all over. Now with sealing wax fasten a needle to a penholder, and by means of this little tool one can easily manufacture diagram slides from the darkened film (white lines on black ground).

Take a spoiled negative, dissolve out all the silver with a solution of potassium ferricyanide and hypo. Rinse, dry, rub with sandpaper, and you will have a splendid substitute for ground glass.

Remove the silver in a similar manner from another negative, but this time wash thoroughly. Squeegee down on this a print, and an opaline will be your reward. From such an opaline, by cementing on a few more glasses, a tasteful letter weight may soon be made. Another way in which very thin negatives may be used is this: Bleach them in bichloride of mercury, back them with black paper, and positives will result. Old negatives also make good trimming boards, the film preventing a rapid blunting of the knife, and they may be successfully used as mounting tables. Clean off the films, polish with French chalk, and squeegee your prints thereto. When dry they may be removed and will have a fine enameled, if hardly artistic, appearance. Many other uses for them may also be found if the amateur is at all ingenious.

Users of pyro, instead of throwing the old developer away, should keep some of it and allow it to oxidize. A thin negative, if immersed in this for a few minutes, will be stained a deep yellow all over, and its printing quality will be much improved.

Old hypo baths should be saved, and, when a sufficient quantity of silver is thought to be in solution, reduced to recover the metal.

Printing paper of any sort is another great source of waste, especially to the inexperienced photographer. Prints are too dark or not dark enough successfully to undergo the subsequent operations. Spoiled material of this kind, however, is not without its uses in photography. Those who swear by the "combined bath," will find that scraps of printing-out paper, or any silver paper, are necessary to start the toning action.

Spoiled mat surface, printing-out paper, bromide paper, or platinotype should be allowed to blacken all over. Here we have a dead-black surface useful for many purposes. A leak in the bellows when out in the field may be repaired temporarily by moistening a piece of mat printing-out paper and sticking it on the leak; the gelatin will cause it to adhere. These papers may also be used to back plates, platinotypes, of course, requiring some adhesive mixture to make them stick.

In every photographer's possession there will be found a small percentage of stained prints. Instead of throwing these away, they may often be turned to good account in the following manner: Take a large piece of cardboard, some mountant, and the prints. Now proceed to mount them tastefully so that the corners of some overlap, arranging in every case to hide the stain. If you have gone properly to work, you will have an artistic mosaic. Now wash round with india ink, or paint a border of leaves, and the whole thing will form a very neat "tit bit."

Keep the stiff bits of cardboard be-

tween which printing paper is packed. They are useful in many ways—from opaque cards in the dark slide to partitions between negatives in the storing boxes.

In reclaiming old gold solutions, all liquids containing gold, with the exception of baths of which cyanide forms a part, must be strongly acidulated with chlorhydric or sulphuric acid, if they are not already acid in their nature. They are afterwards diluted with a large proportion of ordinary water, and a solution of sulphate of ferroprotoxide (green vitriol) is poured in in excess. It is recognized that the filtered liquid no longer contains gold when the addition of a new quantity of ferric sulphate does not occasion any cloudiness. Gold precipitated in the form of a reddish or blackish powder is collected on a filter and dried in an oven with weights equal to its own of borax, saltpeter, and carbonate of potash. The mass is afterwards introduced gradually into a fireproof crucible and carried to a white-red heat in a furnace. When all the matter has been introduced, a stronger blast is given by closing the furnace, so that all the metal collects at the bottom of the crucible. On cooling, a gold ingot, chemically pure, will be obtained. This mode of reduction is also suitable for impure chloride of gold, and for the removal of gilding, but not for solutions containing cyanides, which never give up all the gold they contain; the best means of treating the latter consists in evaporating them to dryness in a cast-iron boiler, and in calcining the residue in an earthen crucible at the white red. A small quantity of borax or saltpeter may be added for facilitating the fusion, but it is not generally necessary. The gold separated collects at the bottom of the crucible. It is red, if saltpeter is employed; and green, if it is borax.

To reclaim silver place the old films, plates, paper, etc., in a porcelain dish, so arranged that they will burn readily. To facilitate combustion, a little kerosene or denatured alcohol poured over the contents will be found serviceable.

Before blowing off the burnt paper, place the residue in an agateware dish, the bottom of which is covered with a solution of saltpeter and water. Place the whole on the fire, and heat it until the silver is separated as a nitrate.

The solution being complete, add to the mass a little water and hydrochloric acid, when in a short time the serviceable silver chloride will be obtained. If the films should not give up their silver as freely as the plates, then add a little more hydrochloric acid or work them up separately. Silver reclaimed in this way is eminently suitable for silver-plating all sorts of objects.

FIXING AND CLEARING BATHS:

The Acid Fixing and Clearing Bath.—Add 2 ounces of S. P. C. clarifier (acid bisulphite of sodium) solution to 1 quart of hypo solution 1 in 5.

Combined Alum and Hypo Bath.—Add saturated solution of sulphite of sodium to saturated solution of alum till the white precipitate formed remains undissolved, and when the odor of sulphurous acid becomes perceptible.

Mix this solution with an equal bulk of freshly prepared hypo solution 1 in 5, and filter.

This bath will remain clear.

Clearing Solution (Edward's).—

Alum	1 ounce	avoirdupois
Citric acid	1 ounce	avoirdupois
Sulphate of iron, crystals	3 ounces	avoirdupois
Water	1 imperial pint	

This should be freshly mixed.

Clearing Solution.—

Saturated solution of alum	20 ounces
Hydrochloric acid	1 ounce

Immerse negative after fixing and washing. Wash well after removal.

Reducer for Gelatin Dry-Plate Negatives.—

I.—Saturated solution of ferricyanide of potassium	1 part	
Hyposulphite of sodium solution (1 in 10)	10 parts	
II.—Perchloride of iron	30 grains	
Citric acid	60 grains	
Water	1 pint	

Belitski's Acid Ferric-Oxalate Reducer for Gelatin Plates.—

Water	7 ounces
Potassium ferric oxalate	2½ drachms
Crystallized neutral sulphite of sodium	2 drachms
Powdered oxalic acid, from 30 to	45 grains
Hyposulphite of soda	1½ ounces

The solution must be made in this order, filtered, and be kept in tightly closed bottles; and as under the influence of light the ferric salt is reduced to fer-

rous, the preparation must be kept in subdued light, in non-actinic glass bottles.

Orthochromatic Dry Plates—Erythrosine Bath (Mallman and Scolik).—Preliminary bath:

Water.....	200 cubic centimeters
Stronger ammonia....	2 cubic centimeters

Soak a plate for 2 minutes.

Color bath:

Erythrosine solution (1 in 1,000) .	25 cubic centimeters
Stronger ammonia (0.900)...	4 cubic centimeters
Water.....	175 cubic centimeters

The plate should not remain longer in the bath than 1¼ minutes.

PAPER-SENSITIZING PROCESSES:

Blueprint Paper.—I.—The ordinary blue photographic print in which white lines appear on a blue ground may be made on paper prepared as follows:

A.—Potassium ferricyanide.....	10 drachms
Distilled water.....	4 ounces
B.—Iron ammonia citrate.	15 drachms
Distilled water.....	4 ounces

Mix when wanted for use, filter, and apply to the surface of the paper.

With this mixture no developer is required. The paper after exposure is simply washed in water to remove the unaltered iron salts. The print is improved by immersion in dilute hydrochloric acid, after which it must be again well washed in water.

II.—**"Electric Rapid" Blue Print Paper.**—

	Pints Water	
A.	13	6 lbs. Iron ammonium oxalate
B.	15	3¾ lbs. Iron sodium oxalate
C.	15	4¼ lbs. Iron ammonium citrate
D.	2	5 ozs. Iron oxalate
E.	15	2⅛ lbs. Potassium ferricyanide ¼ lb. Iron potassium oxalate

Mix for use as follows:

8	pints of *A.*	½	pint of *D.*
1	pint of *B.*	2	pints of *E.*
1⅛	pints of *C.*	6	pints of *Water*

No. 2 Formula

3½ pints water
1¾ ozs. Potassium ferricyanide
⅞ oz. Iron ammonium citrate
1⅓ ozs. Iron sodium oxalate
6½ ozs. Iron ammonium oxalate

No. 3 Formula

4½ pints water
3¼ ozs. Iron sodium oxalate
1/16 oz. Potassium bichromate
5 ozs. Iron ammonium citrate
44/100 oz. Iron oxalate
1⅜ oz. Potassium ferricyanide
¾ oz. Citric acid

These three formulas for Blue Print Paper are superior to the general run of so-called "Electric Rapid" printing paper in respect to retaining color when re-exposed to sunlight. Prints made on the old style "Electric Rapid" Blue Print Paper fade when re-exposed to sunlight. These do not.

III.—Dissolve 3¾ ounces of ammonia citrate of iron in 18 ounces of water, and put in a bottle. Then dissolve 2⅝ ounces of red prussiate of potash in 18 ounces of water, and put in another bottle. When ready to prepare the paper, have the sheets piled one on top of the other, coating but one at a time. Darken the room, and light a ruby lamp. Now, mix thoroughly equal parts of both solutions and apply the mixture with a sponge in long parallel sweeps, keeping the application as even as possible. Hang the paper in the dark room to dry and keep it dark until used. Any of the mixture left from sensitizing the paper should be thrown away, as it deteriorates rapidly.

Often, in making blueprints by sunlight, the exposure is too long, and when the frame is opened the white lines of the print are faint or obscure. Usually these prints are relegated to the waste basket; but if, after being washed as usual, they are sponged with a weak solution of chloride of iron, their reclamation is almost certain. When the lines reappear, the print should be thoroughly rinsed in clear water.

Often a drawing, from which prints have already been made, requires changing. The blueprints then on hand are worthless, requiring more time to correct

than it would take to make a new print. An economical way of using the worthless prints is to cancel the drawing already thereon, sensitize the reverse side, and use the paper again.

How to Make Picture Postal Cards and Photographic Letter Heads.—I.—Well-sized paper is employed. If the sizing should be insufficient, resizing can be done with a 10 per cent gelatin solution, with a 2 per cent arrowroot paste, or with a 50 per cent decoction of carrageen. This size is applied on the crude paper with a brush and allowed to dry. The well-sized or resized papers are superior and the picture becomes stronger on them than on insufficiently sized paper. Coat this paper uniformly with a solution of 154 grains of ferric oxalate in 3½ fluidounces of distilled water, using a brush, and allow to dry. Next, apply the solution of 15½ grains of silver nitrate in 3½ fluidounces of water with a second brush, and dry again. Coating and drying must be conducted with ruby light or in the dark.

The finished paper keeps several days. Print deep so as to obtain a strong picture and develop in the following bath:

Distilled water...	3½ fluidounces
Potassium oxalate (neutral)..	340 grains
Oxalic acid.....	4 grains

After developing the well-washed prints, fix them preferably in the following bath:

Distilled water..	3½ fluidounces
Sodium thiosulphate.....	75 grains
Gold chloride solution (1 in 100).....	80 minims

Any other good bath may be employed.

II.—Starch is dissolved in water and the solution is boiled until it forms a thin paste. Carmine powder is added, and the mixture is rapidly and assiduously stirred until it is homogeneous throughout. It is now poured through muslin and spread by means of a suitable pencil on the paper to be sensitized. Let dry, then float it, prepared side down on a solution of potassium chromate, 30 parts in 520 parts of distilled water, being careful to prevent any of the liquid from getting on the back or reverse side. Dry in the dark room, and preserve in darkness. When desired for use lay the negative on the face of the paper, and expose to the full sunlight for 5 or 6 minutes (or about an hour in diffused light). Washing in plenty of water completes the process.

A Simple Emulsion for Mat or Printing-Out Paper.—One of the very best surfaces to work upon for coloring in water color is the carbon print. Apart from its absolute permanency as a base, the surface possesses the right tooth for the adhering of the pigment. It is just such a surface as this that is required upon other prints than carbon, both for finished mat surfaces and for the purposes of coloring. The way to obtain this surface upon almost any kind of paper, and to print it out so that the correct depth is ascertained on sight, will be described. Some of the crayon drawing papers can be utilized, as well as many other plain photographic papers that may meet the desires of the photographer. If a glossy paper is desired, the emulsion should be coated on a baryta-coated stock.

There will be required, in the first place, 2 half-gallon stoneware crocks with lids. The best shape to employ is a crock with the sides running straight, with no depressed ridge at the top. One of these crocks is for the preparation of the emulsion, the other to receive the emulsion when filtered. An enameled iron saucepan of about 2 gallons capacity will be required in which to stand the crock for preparing the emulsion, and also to remelt the emulsion after it has become set. The following is the formula for the emulsion, which must be prepared and mixed in the order given. Failure will be impossible if these details are scrupulously attended to.

Having procured 2 half-gallon stoneware crocks with lids, clean them out well with hot and cold water, and place into one of these the following:

Distilled water.....	10 ounces
Gelatin (Heinrich's, hard).....	4 ounces

Cut the gelatin into shreds with a clean pair of scissors. Press these shreds beneath the water with a clean strip of glass and allow to soak for 1 hour. Now proceed to melt the water-soaked gelatin by placing the crock into hot water in the enameled saucepan, the water standing about half way up on the outside of the crock. Bring the water to boiling point, and keep the gelatin occasionally stirred until it is completely dissolved. Then remove the crock to allow the contents to cool down to 120° F. Now prepare the following, which can be done while the gelatin is melting:

No. 1

Rochelle salts.....	90 grains
Distilled water.....	1 ounce

No. 2

Chloride of ammonium.....	45 grains
Distilled water.....	1 ounce

No. 3

Nitrate of silver, 1 ounce and.....	75 grains
Citric acid (crushed crystals).....	95 grains
Distilled water.....	10 ounces

No. 4

Powdered white alum	90 grains
Distilled water (hot)..	5 ounces

The latter solution may be made with boiling water. When these solutions are prepared, pour into the hot gelatin solution No. 1, stirring all the while with a clean glass rod. Then add No. 2. Rinse the vessel with a little distilled water, and add to the gelatin. Now, while stirring gradually, add No. 3, and lastly add No. 4, which may be very hot. This will cause a decided change in the color of the emulsion. Lastly add 2 ounces of pure alcohol (photographic). This must be added very gradually with vigorous stirring, because if added too quickly it will coagulate the gelatin and form insoluble lumps. The emulsion must, of course, be mixed under a light not stronger than an ordinary small gas-jet, or under a yellow light obtained by covering the windows with yellow paper. The cover may now be placed upon the crock, and the emulsion put aside for 2 or 3 days to ripen.

At the end of this time the contents of the crock, now formed into a stiff emulsion, may be remelted in hot water by placing the crock in the enameled saucepan over a gas stove. The emulsion may be broken up by cutting it with a clean bone or hard-rubber paper cutter to facilitate the melting. Stir the mixture occasionally until thoroughly dissolved, and add the following as soon as the emulsion has reached a temperature of about 150° F.:

Distilled water.....	4 ounces
Pure alcohol.....	1 ounce

The emulsion must now be filtered into the second crock. The filtering is best accomplished in the following manner: Take an ordinary plain-top kerosene lamp chimney, tie over the small end two thicknesses of washed cheese cloth. Invert the chimney and insert a tuft of absorbent cotton about the size of an ordinary egg. Press it carefully down upon the cheese cloth. Fix the chimney in the ring of a retort stand (or cut a hole about 3 inches in diameter in a wooden shelf), so that the crock may stand conveniently beneath. In the chimney place a strip of glass, resting upon the cotton, to prevent the cotton from lifting. Now pour in the hot emulsion and allow the whole of it to filter through the absorbent cotton. This accomplished, we are now ready for coating the paper, which is best done in the following manner:

Cut the paper into strips or sheets, say 12 inches wide and the full length of the sheet. This will be, let us suppose, 12 x 26 inches. Attach, by means of the well-known photographic clips, a strip of wood at each end of the paper upon the back. Three clips at each end will be required. Having a number of sheets thus prepared, the emulsion should be poured into a porcelain pan or tray, kept hot by standing within another tray containing hot water. The emulsion tray being, say, 11 x 14 size, the paper now is easily coated by holding the clipped ends in each hand, then holding the left end of the paper up, and the right-hand end lowered so that the curve of the paper just touches the emulsion. Then raise the right hand, at the same time lowering the left hand at the same rate. Then lower the right hand, lifting the left. Repeat this operation once more; then drain the excess of emulsion at one corner of the tray, say, the left-hand corner. Just as soon as the emulsion has drained, the coated sheet of paper may be hung up to dry, by the hooks attached to the clips, upon a piece of copper wire stretched from side to side of a spare closet or room that can be kept darkened until the paper is dry. In this way coat as much paper as may be required. When it is dry it may be rolled up tight or kept flat under pressure until needed.

If any emulsion remains it may be kept in a cool place for 2 weeks, and still be good for coating. Be sure to clean out all the vessels used before the emulsion sets, otherwise this will present a difficult task, since the emulsion sets into an almost insoluble condition.

This emulsion is so made that it does not require to be washed. If it is washed it will become spoiled. It is easy to make and easy to use. If it is desired that only small sheets of paper are to be coated, they may be floated on the emulsion, but in this case the paper must be damp, which is easily accomplished by

wetting a sheet of blotting paper, then covering this with two dry sheets of blotting paper. Place the sheets to be coated upon these, and place under pressure during the night. Next day they will be in good condition for floating.

When the coated paper is dry it may be printed and toned just the same as any other printing-out paper, with any toning bath, and fixed in hyposulphite of soda as usual. Toning may be carried to a rich blue black, or if not carried too far will remain a beautiful sepia color. After well washing and drying, it will be observed that the surface corresponds with that of a carbon print; if the paper has been of a somewhat absorbent character, the surface will be entirely mat, and will give an excellent tooth for coloring or finishing in sepia, black and white, etc.

How to Sensitize Photographic Printing Papers.—I.—The older form of paper is one in which the chemicals are held by albumen. Silver is said to combine with this, forming an albuminate. Pictures printed on this would be too sharp in their contrasts, and consequently "hard"; this is avoided by introducing silver chloride.

To prepare this form of paper, beat 15 ounces of fresh egg albumen with 5 ounces of distilled water, dissolve in it 300 grains of ammonium chloride, set aside for a time, and decant or filter. Suitable paper is coated with this solution by floating, and then dried. The paper is "sensitized" by floating it on a solution of silver nitrate in distilled water, about 80 grains to the ounce, with a drop of acetic acid. The paper is dried as before, and is then ready for printing. The sensitizing must, of course, be done in the dark room.

The reaction between the ammonium chloride present in the albumen coating produces a certain quantity of silver chloride, the purpose of which is shown above. Of course, variations in the proportions of this ingredient will give different degrees of softness to the picture.

II.—The bromide and chloride papers which are now popular consist of the ordinary photographic paper sensitized by means of a thin coating of bromide or chloride emulsion. In "Photographic Printing Methods," by the Rev. W. H. Burbank, the following method is given for bromide paper:

A.—Gelatin (soft)	42½	grains
Bromide of potassium	26	grains
Distilled water	1	ounce
B.—Nitrate of silver	33⅓	grains
Distilled water	1	ounce

Dissolve the bromide first, then add the gelatin and dissolve by gentle heat (95° to 100° F.). Bring the silver solution to the same temperature, and add in a small stream to the gelatin solution, stirring vigorously, of course in non-actinic light. Keep the mixed emulsion at a temperature of 105° F. for half an hour, or according to the degree of sensitiveness required, previously adding 1 drop of nitric acid to every 5 ounces of the emulsion. Allow it to set, squeeze through working canvas, and wash 2 hours in running water. In his own practice he manages the washing easily enough by breaking the emulsion up into an earthen jar filled with cold water, and placed in the dark room sink. A tall lamp chimney standing in the jar immediately under the tap conducts fresh water to the bottom of the jar, and keeps the finely divided emulsion in constant motion; a piece of muslin, laid over the top of the jar to prevent any of the emulsion running out, completes this simple, inexpensive, but efficient washing apparatus.

Next melt the emulsion and add one-tenth of the whole volume of glycerine and alcohol; the first to prevent troublesome cockling of the paper as it dries, the second to prevent air bubbles and hasten drying. Then filter.

With the emulsion the paper may be coated just as it comes from the stock dealer, plain, or, better still, given a substratum of insoluble gelatin, made as follows:

Gelatin	1⅔	grains
Water	1	ounce

Dissolve and filter; then add 11 drops of a 1 in 50 filtered chrome alum solution. The paper is to be floated for half a minute on this solution, avoiding air bubbles, and then hung up to dry in a room free from dust. The purpose of this substratum is to secure additional brilliancy in the finished prints by keeping the emulsion isolated from the surface of the paper. The paper should now be cut to the size desired.

We do not know of these processes having been applied to postal cards, but unless there is some substance in the sizing of the card which would interfere, there is no reason why it should not be. Of course, however, a novice will not get the results by using it that an experienced hand would.

Ferro-Prussiate Paper.—The following aniline process of preparing sensitive paper is employed by the Prussian and Hessian railway administrations. The

ordinary paper on reels is used for the purpose, and sensitized as follows:

Two hundred and fifty parts, by weight, of powdered potassium bichromate are dissolved in water; the solution should be completely saturated; 10 parts of concentrated sulphuric acid, 10 parts of alcohol (962), and 30 parts of phosphoric acid, are added successively, and the whole stirred together. The solution is sponged over the paper. It is not necessary to have the room absolutely dark, or to work by a red light, still the light should be obscured. The drying of the paper, in the same place, takes about 10 minutes, after which the tracing to be reproduced and the paper are placed in a frame, as usual, and exposed to daylight. On a sunny day, an exposure of 35 seconds is enough; in cloudy weather, 60 to 70 seconds; on a very dark day, as much as 5 minutes.

After exposure, the paper is fixed by suspending it for 20 minutes upon a bar in a closed wooden box, on the bottom of which are laid some sheets of blotting paper, sprinkled with 40 drops of benzine and 20 of crude aniline oil. The vapors given off will develop the design. Several impressions may be taken at the same time.

For fixing, crude aniline oil is to be used (anilinum purum), not refined (purissimum), for the reason that the former alone contains the substances necessary for the operation. The reproduced design is placed in water for a few minutes, and hung up to dry.

Pigment Paper for Immediate Use.—Pigment paper is usually sensitized in the bichromate solution on the evening before it is desired for use. If it is not then used it will spoil. By proceeding as follows the paper may be used within a quarter of an hour after treating it in the bichromate bath. Make a solution of

Ammonium bichromate	75 grains
Water	3½ fluidounces
Sodium carbonate	15 grains

Mix 0.35 ounces of this solution with 0.7 ounces alcohol, and with a broad brush apply to surface of the pigment paper, as evenly as possible. Dry this paper as quickly as possible in a pasteboard box of suitable size, 15 minutes being usually long enough for the purpose. It may then be used at once.

Photographing on Silk.—China silk is thoroughly and carefully washed to free it from dressing, and then immersed in the following solution:

Sodium chloride	4 parts
Arrowroot	4 parts
Acetic acid	15 parts
Distilled water	100 parts

Dissolve the arrowroot in the water by warming gently, then add the remaining ingredients. Dissolve 4 parts of tannin in 100 parts of distilled water and mix the solutions. Let the silk remain in the bath for 3 minutes, then hang it carefully on a cord stretched across the room to dry. The sensitizing mixture is as follows:

Silver nitrate	90 parts
Distilled water	750 parts
Nitric acid	1 part

Dissolve. On the surface of this solution the silk is to be floated for 1 minute, then hung up till superficially dry, then pinned out carefully on a flat board until completely dry. This must, of course, be done in the dark room. Print, wash, and tone in the usual manner.

TONING BATHS FOR PAPER.

The chief complaints made against separate baths are (1) the possibility of double tones, and (2) that the prints sometimes turn yellow and remain so. Such obstacles may easily be removed by exercising a little care. Double tones may be prevented by soaking the prints in a 10 per cent solution of common salt before the preliminary washing, and by not touching the films with the fingers; and the second objection could not be raised provided fresh solution were used, with no excess of sulphocyanide, if this be the bath adopted.

A very satisfactory solution may be made as follows:

Sodium phosphate	20 grains
Gold chloride	1½ grains
Distilled (or boiled) water	10 ounces

This tones very quickly and evenly, and the print will be, when fixed, exactly the color it is when removed from the bath. Good chocolate tints may be obtained, turning to purple gray on prolonged immersion.

Next to this, as regards ease of manipulation, the tungstate bath may be placed, the following being a good formula:

Sodium tungstate	40 grains
Gold chloride	2 grains
Water	12 ounces

The prints should be toned a little further than required, as they change color, though only slightly, in the hypo.

Provided that ordinary care be exercised, the sulphocyanide bath cannot well be improved upon. The formulas given by the various makers for their respective papers are all satisfactory, and differ very little. One that always acts well is

Ammonium sulphocyanide	28 grains
Distilled water	16 ounces
Gold chloride	2½ grains

For those who care to try the various baths, and to compare their results, here is a table showing the quantities of different agents that may be used with sufficient water to make up 10 ounces:

Gold chloride, 1 gr. to 1 oz. water	12 dr.	16 dr.	16 dr.	11 dr.	11 dr.	14 dr.
Borax	60 gr.					
Sod. bicarbonate	.....	10 gr.				
Sod. carbonate	.....	.....	20 gr.			
Sod. phosphate	.....	.....	.....	20 gr.		
Sod. tungstate	.....	.....	.....	.....	40 gr.	
Amm. sulphocyanide	.....	.....	.....	.....	.....	17.5 gr.

We may take it that any of these substances reduce gold trichloride, $AuCl_3$ to AuCl; this AuCl apparently acts as an electrolyte, from which gold is deposited on the silver of the image, and at the same time a small quantity of silver combines with the chlorine of the gold chloride thus:

$$AuCl + Ag = AgCl + Au$$

When toning has been completed, the prints are washed and placed in the fixing bath, when the sodium thiosulphate present dissolves any silver chloride that has not been affected by light.

Besides the well-known, every-day tones we see, which never outstep the narrow range between chocolate brown and purple, a practically infinite variety of color, from chalk red to black, may be obtained by a little careful study of toning baths instead of regarding them as mere unalterable machines. Most charming tints are produced with platinum baths, a good formula being

Strong nitric acid	5 drops
Water	4 ounces
Chloro-platinite of potassium	1 grain

The final tone of a print cannot be judged from its appearance in the bath, but some idea of it may be got by holding it up to the light and looking through it. A short immersion gives various reds, while prolonged toning gives soft grays.

Results very similar to platinotype may be obtained with the following combined gold and platinum bath:

A.—Sodium acetate	1 drachm
Water	4 ounces
Gold chloride	1 grain
B.—Chloro-platinite of potassium	1 grain
Water	4 ounces

Mix *A* and *B* and neutralize with nitric acid. (The solution will be neutral when it just ceases to turn red litmus paper blue.)

Another toning agent is stannous chloride. Two or three grains of tin foil are dissolved in strong hydrochloric acid with the aid of heat. The whole is then made up to about 4 ounces with water.

Toning Baths for Silver Bromide Paper.—The picture, which has been exposed at a distance of 1½ feet for about 8 to 10 seconds, is developed in the customary manner and fixed in an acid fixing bath composed of

Distilled water	1,000 cubic centimeters
Hyposulphite of soda	100 grams
Sodium sulphite	20 grams
Sulphuric acid	4 to 5 grams

First dissolve the sodium sulphite, then add the sulphuric acid, and finally the hyposulphite, and dissolve.

Blue tints are obtained by laying the picture in a bath composed as follows:

A.—Uranium nitrate	2 grams
Water	200 cubic centimeters
B.—Red prussiate of potash	2 grams
Water	200 cubic centimeters
C.—Ammonia-iron-alum	10 grams
Water	100 cubic centimeters
Pure hydrochloric acid	15 cubic centimeters

Immediately before the toning, mix

Solution *A*	200 cubic centimeters
Glacial acetic acid	20 cubic centimeters
Solution *B*	200 cubic centimeters
Solution *C*	30 to 40 cubic centimeters

Brown tints. Use the following solutions:

A.—Uranium nitrate..... 12 grams
Water..... 1,000 cubic centimeters

B.—Red prussiate of potash... 9 grams
Water..... 1,000 cubic centimeters

And mix immediately before use

Solution *A*.. 100 cubic centimeters
Solution *B*.. 100 cubic centimeters
Glacial acetic acid... 10 cubic centimeters

Pictures toned in this bath are then laid into the following solution:

Water..... 1,500 cubic centimeters
Pure hydrochloric acid..... 5 cubic centimeters
Citric acid.. 20 grams

To Turn Blueprints Brown.—A piece of caustic soda about the size of a bean is dissolved in 5 ounces of water and the blueprint immersed in it, on which it will take on an orange-yellow color. When the blue has entirely left the print it should be washed thoroughly and immersed in a bath composed of 8 ounces of water in which has been dissolved a heaping teaspoonful of tannic acid. The prints in this bath will assume a brown color that may be carried to almost any tone, after which they must again be thoroughly washed and allowed to dry.

COMBINED TONING AND FIXING BATHS.

The combined toning and fixing bath consists essentially of five parts—(1) water, the solvent; (2) a soluble salt of gold, such as gold chloride; (3) the fixing agent, sodium thiosulphate; (4) a compound which will readily combine with "nascent" sulphur—i. e., sulphur as it is liberated—this is usually a soluble lead salt, such as the acetate or nitrate, and (5) an auxiliary, such as a sulphocyanide.

The simplest bath was recommended by Dr. John Nicol, and is as follows:

Sodium thiosulphate. 3 ounces
Distilled water..... 16 ounces

When dissolved, add

Gold chloride.... 4 grains
Distilled water... 4 fluidrachms

A bath which contains lead is due to Dr. Vogel, whose name alone is sufficient to warrant confidence in the formula:

Sodium thiosulphate 7 ounces
Ammonium sulphocyanide..... 1 ounce
Lead acetate .....67 grains
Alum..... 1 ounce

Gold chloride.....12 grains
Distilled water.....35 fluidounces

A bath which contains no lead is one which has produced excellent results and is due to the experimental research of Dr. Liesegang. It is as follows:

Ammonium sulphocyanide.... ¼ ounce
Sodium chloride.. 1 ounce
Alum..... ½ ounce
Sodium thiosulphate..... 4 ounces
Distilled water... 24 fluidounces

Allow this solution to stand for 24 hours, during which time the precipitated sulphur sinks to the bottom of the vessel; decant or filter, and add

Gold chloride.... 8 grains
Distilled water... 1 fluidounce

It is curious that, with the two baths last described, the addition to them of some old, exhausted solution makes them work all the better.

ENLARGEMENTS.

TIMES OF ENLARGEMENT AND REDUCTION

Focus of Lens In.	1 inch	2 inches	3 inches	4 inches	5 inches	6 inches	7 inches	8 inches
2	4 4	6 3	8 2⅔	10 2½	12 2⅖	14 2⅓	16 2⅐	18 2¼
2½	5 5	7½ 3¾	10 3⅓	12½ 3⅛	15 3	17½ 2 11/16	20 2 6/7	22½ 2 3/16
3	6 6	9 4½	12 4	15 3¾	18 3⅗	21 3½	24 3 3/7	27 3⅜
3½	7 7	10½ 5¼	14 4⅔	17½ 4 3/4	21 4⅕	24½ 4 1/12	28 4	31½ 3 9/10
4	8 8	12 6	16 5⅓	20 5	24 4⅘	28 4⅔	32 4⅐	36 4½
4½	9 9	13½ 6¾	18 6	22½ 5 2/8	27 5⅖	31½ 5¼	36 5⅐	40½ 5 1/16
5	10 10	15 7½	20 6⅔	25 6¼	30 6	35 5⅚	40 5⅐	45 5⅝
5½	11 11	16½ 8¼	22 7⅓	27½ 6⅛	33 6½	38½ 6 5/12	44 6⅔	49½ 6 5/16
6	12 12	18 9	24 8	30 7½	36 7⅕	42 7	48 6⅞	54 6¾
7	14 14	21 10½	28 9⅓	35 8¾	42 8⅖	49 8⅙	56 8	63 7⅞
8	16 16	24 12	32 10⅔	40 10	48 9⅗	56 9⅓	64 9⅐	72 9
9	18 18	27 13½	36 12	45 11¼	54 10⅘	63 10½	72 10⅔	81 10⅛

The object of this table is to enable any manipulator who is about to enlarge (or reduce) a copy any given number of times to do so without troublesome calculation. It is assumed that the photographer knows exactly what the focus of his lens is, and that he is able to measure accurately from its optical center. The use of the table will be seen from the following illustration: A photographer has a *carte* to enlarge to four times its size, and the lens he intends employing is one of 6 inches equivalent focus. He must therefore look for 4 on the upper horizontal line and for 6 in the first vertical column, and carry his eye to where these two join, which will be at 30–7½. The greater of these is the distance the sensitive plate must be from the center of the lens; and the lesser, the distance of the picture to be copied. To reduce a picture any given number of times, the same method must be followed; but in this case the greater number will represent the distance between the lens and the picture to be copied, the latter that between the lens and the sensitive plate. This explanation will be sufficient for every case of enlargement or reduction.

If the focus of the lens be 12 inches, as this number is not in the column of focal lengths, look out for 6 in this column and multiply by 2, and so on with any other numbers.

To make a good enlargement five points should be kept constantly in view, viz.:

1. Most careful treatment of the original negative.
2. Making a diapositive complete in all its parts.
3. Scrupulous consideration of the size of the enlargement.
4. Correct exposure during the process of enlargement.
5. The most minute attention to the details of development, including the chemical treatment of the enlarged negative.

The original negative should not be too dense, nor, on the contrary, should it be too thin. If necessary, it should be washed off, or strengthened, as the case may be. Too strong a negative is usually weakened with ammonium persulphate, or the fixing hypo solution is quite sufficient. All spots, points, etc., should be retouched with the pencil and carmine.

The diapositive should be produced by contact in the copying apparatus. A border of black paper should be used to prevent the entry of light from the side.

The correct period of exposure depends upon the thickness of the negative, the source of the light, its distance, etc. Here there is no rule, experience alone must teach.

For developing one should use not too strong a developer. The metol-soda developer is well suited to this work, as it gives especially soft lights and half tones. Avoid too short a development. When the finger laid behind the thickest spot, and held toward the light, can no longer be detected, the negative is dense enough.

The denser negatives should be exposed longer, and the development should be quick, while with thin, light negatives the reverse is true; the exposure should be briefer and the development long, using a strong developer, and if necessary with an addition of potassium bromide.

The silver chloro-bromide diapositive plates, found in the shops, are totally unsuited for enlargements, as they give overdone, hard pictures.

To produce good artistic results in enlarging, the diapositive should be kept soft, even somewhat too thin. It should undergo, also, a thorough retouching. All improvements are easily carried out on the smaller positive or negative pictures. Later on, after the same have been enlarged, corrections are much more difficult and troublesome.

VARNISHES:

Cold Varnish.—

I.—Pyroxylin.....	10 grains
Amyl alcohol.....	1 ounce
Amyl acetate.....	1 ounce

Allow to stand, shaking frequently till dissolved. Label: The negative should be thoroughly dried before this solution is applied, which may be done either by flowing it over the solution or with a flat brush. The negative should be placed in a warm place for at least 12 hours to thoroughly dry.

II.—Japanese gold size ..	Equal parts.
Benzol.....	

Label: In applying this varnish great care should be taken not to use it near a light or open fire. It can be flowed over or brushed on the negative.

Black Varnish.—

Brunswick black...	1½ ounces
Benzol.....	1 ounce

Label: The varnish should be applied with a brush, care being taken not to use it near a light or open fire.

Dead Black Varnish.—

Borax	30 grains
Shellac	60 grains
Glycerine	30 minims
Water	2 ounces

Boil till dissolved, filter, and add aniline black, 120 grains.

Label: Apply the solution with a brush, and repeat when dry if necessary.

Ordinary Negative Varnish.—

Gum sandarac	1 ounce
Orange shellac	½ ounce
Castor oil	90 minims
Methyl alcohol	1 pint

Allow to stand with occasional agitation till dissolved, and then filter. Label: The negative should be heated before a fire till it can be comfortably borne on the back of the hand, and then the varnish flowed over, any excess being drained off, and the negative should then be again placed near the fire to dry.

Water Varnish.—It is not only in connection with its application to a wet collodion film that water varnish forms a valuable addition to the stock of chemicals in all-round photography; it is almost invaluable in the case of gelatin as with wet collodion films. In the case of gelatin negatives the water varnish is applied in the shape of a wash directly after the negatives have been washed to free their films from all traces of hypo, or in other words, at that stage when the usual drying operation would begin. After the varnish has been applied the films are dried in the usual manner, and its application will soon convince anyone that has experienced the difficulty of retouching by reason of the want of a tooth in the film to make a lead-pencil bite, as the saying goes, that were this the only benefit accruing from its application it is well worthy of being employed.

The use of water varnish, however, does away with the necessity of employing collodion as an additional protection to a negative, and is, perhaps, the best known remedy against damage from silver staining that experienced workers are acquainted with. As a varnish it is not costly, neither is it difficult to make in reasonably small quantities, while its application is simplicity itself. The following formula is an excellent sample of water varnish:

Place in a clean, enameled pan 1 pint of water, into which insert 4 ounces of shellac in thin flakes, and place the vessel on a fire or gas stove until the water is raised to 212° F. When this temperature is reached a few drops of hot, saturated solution of borax is dropped into the boiling pan containing the shellac and water, taking care to stir vigorously with a long strip of glass until the shellac is all dissolved. Too much borax should not be added, only just sufficient to cause the shellac to dissolve, and it is better to stop short, if anything, before all the flakes dissolve out than to add too much borax. The solution is then filtered carefully and, when cold, the water varnish is ready for use.

FADED PHOTOGRAPHS AND THEIR TREATMENT:

Restoring Faded Photographs.—I.—As a precaution against a disaster first copy the old print in the same size. Soak the faded photograph for several hours in clean water and, after separating print from mount, immerse the former in nitric acid, highly dilute (1 per cent), for a few minutes. Then the print is kept in a mercury intensifier (mercuric chloride, ½ ounce; common salt, ½ ounce; hot water, 16 ounces, used cold), until bleached as much as possible. After half an hour's rinsing, a very weak ammonia solution will restore the photograph, with increased vigor, the upper tones being much improved, though the shadows will show some tendency to clog. The net result will be a decided improvement in appearance; but, at this stage, any similarly restored photographs should be recopied if their importance warrants it, as mercury intensifier results are not permanent. It may be suggested that merely rephotographing and printing in platinotype will probably answer.

II.—Carefully remove the picture from its mount, and put it in a solution of the following composition:

	By weight
Hydrochloric acid	2 parts
Sodium chloride	8 parts
Potassium bichromate	8 parts
Distilled water	250 parts

The fluid bleaches the picture, but photographs that have been toned with gold do not quite vanish. Rinse with plenty of water, and develop again with very dilute alkaline developer.

MOUNTANTS:

See also Adhesives.

I.—If buckling of the mount is to be cured, the prints must be mounted in a dry state, and the film of mountant borne by the print must be just sufficient to attach it firmly to the mount and no more. The great virtue of the method

here described consists of the marvelously thin film of tenacious mountant applied to the print in its dry condition, shrinkage by this means being entirely obviated. A drawing board with a perfectly smooth surface and of fair dimensions, an ivory or bone burnisher attached to a short handle, with some common glue, are the principal requisites. Take, say, a quarter of a pound of the glue broken into small pieces and cover it with water in a clean gallipot, large enough to allow for the subsequent swelling of the glue. Place on one side until the glue has become thoroughly permeated by the water, then pour off the excess and dissolve the glue in the water it has absorbed, by placing the gallipot in a vessel of hot water. The solution tested with a piece of blue litmus paper will show a distinctly acid reaction, which must be carefully neutralized by adding some solution of carbonate of soda. The amount of water absorbed by the glue will probably be too little to give it the best working consistency, and, if this is the case, sufficient should be added to make it about the thickness of ordinary molasses. Careful filtration through a cambric handkerchief, and the addition of about 10 grains of thymol, completes the preparation of the mounting solution. As glue deteriorates by frequent and prolonged heating, it is preferable to make up a stock solution, from which sufficient for the work in hand can be taken in the form of jelly, melted, and used up at once.

The finished prints, dried and trimmed to the required size, are placed on the boards they are to occupy when mounted, and, as it is impossible to remove a print for readjustment once it is laid down for final mounting, the wisest course is to indicate by faint pencil marks on the mount the exact position the print is to occupy; then it may be laid down accurately and without any indecision. A small gas or oil stove is required on the mounting table to keep the glue liquid, but maintaining the solution in a constant state of ebullition throughout the operation is unnecessary and harmful to the glue; the flame should be regulated so that the mountant is kept just at the melting point. Place the drawing board beside the gas stove and with a house-painter's brush of good quality and size spread the glue over an area considerably exceeding the dimensions of the print to be mounted. A thin coating of glue evenly applied to the board is the end to aim at, to accomplish which the brush should be worked in horizontal strokes, crossing these with others at right angles. Have at hand a small pile of paper cut into pieces somewhat larger than the print to be mounted (old newspaper answers admirably for these pieces), lay one down on the glued patch and press it well into contact by passing the closed hand across it in all directions. Raise one corner of the paper, and slowly but firmly strip it from the board. Repeat the operations of gluing the board (in the same place) and stripping the newspaper 2 or 3 times, when a beautifully even cushion of glue will remain on the board.

Mounting the prints is the next step. The cushion of glue obtained on the board has to be coated with glue for, say, every second print, but the amount applied must be as small as possible. After applying the glue the print is laid down upon it, a square of the waste newspaper laid over the print, which has then to be rubbed well into contact with the glue. Raise a corner of the print with the point of a penknife and strip it from the board, as in the case of the newspaper. Care must be taken when handling the print in its glued condition to keep the fingers well beyond the edges of the print, in order that no glue may be abstracted from the edges. Lay the print quickly down upon its mount; with a clean, soft linen duster smooth it everywhere into contact, place upon it a square of photographic drying board, and with the bone burnisher go over it in all directions, using considerable pressure. The finished result is a mounted print that shows no signs of buckling, and which adheres to the mount with perfect tenacity.

II.—Gelatin.....	2 parts
Water.....	4 parts
Alcohol.....	8 parts

The alcohol is added slowly as soon as the gelatin is well dissolved in the water, and the vessel turned continually to obtain a homogeneous mixture. The solution must be kept hot during the operation on a water bath, and should be applied quickly, as it soon dries; the print must be placed exactly the first time, as it adheres at once. The solution keeps for a long time in well-corked bottles.

TRANSPARENT PHOTOGRAPHS:

I.—The following mixture may be employed at 176° F., to render photographs transparent. It consists of 4 parts paraffine and 1 part linseed oil. After immersion the photographs are at once

dried between blotting paper. For fastening these photographs to glass, glue or gelatin solution alone cannot be employed. This is possible only when one-fourth of its weight of sugar has been added to the glue before dissolving. The glasses for applying the photographs must be perfect, because the slightest defects are visible afterwards.

II.—If on albumen paper, soak the print overnight in a mixture of 8 ounces of castor oil and 1 ounce of Canada balsam. Plain paper requires a much shorter time. When the print is thoroughly soaked, take it from the oil, drain well, and lay it on the glass face downward, and squeeze till all is driven out and the print adheres. If a curved glass is used, prepare a squeegee with edge parallel with the curvature of the glass. It will take several hours before the print is dry enough to apply color to it.

THE GUM-BICHROMATE PHOTO-PRINTING PROCESS.

Gum bichromate is not a universal printing method. It is not suited for all subjects or for all negatives, but where there is simplicity and breadth in sizes of 8½ x 6½ and upward, direct or enlarged prints by it have a charm altogether their own, and afford an opportunity for individuality greater than any other method.

While almost any kind of paper will do, there are certain qualities that the beginner at least should endeavor to secure. It should be tough enough to stand the necessary handling, which is considerably more than in either the printing-out or developing methods. It must not be so hard or smooth as to make coating difficult, nor so porous as to absorb or let the coating sink in too much; but a few trials will show just what surface is best. Till that experience is acquired it may be said that most of Whatman's or Michallet's drawing papers, to be had at any artist's materials store, will be found all that can be desired; or, failing these, the sizing of almost any good paper will make it almost as suitable.

For sizing, a weak solution of gelatin is generally employed, but arrowroot is better; half an ounce to a pint of water. It should be beaten into a cream with a little of the water, the rest added, and brought to the boil. When cold it may be applied with a sponge or tuft of cotton, going several times, first in one direction and then in the other, and it saves a little future trouble to pencil mark the non-sized side.

The quality of the gum is of less importance than is generally supposed, so long as it is the genuine gum arabic, and in round, clean "tears." To make the solution select an 8-ounce, wide-mouthed bottle, of the tall rather than the squat variety, and place in it 6 ounces of water. Two ounces of the gum are then tied loosely in a piece of thin muslin and suspended in the bottle so as to be about two-thirds covered by the water. Solution begins at once, as may be seen by the heavier liquid descending, and if kept at the ordinary temperature of the room may not be complete for 24 or even 48 hours; but the keeping qualities of the solution will be greater than if the time had been shortened by heat. When all that will has been dissolved, there will still be a quantity of gelatinous matter in the muslin, but on no account must it be squeezed out, as the semi-soluble matter thus added to the solution would be injurious. With the addition of a few drops of carbolic acid and a good cork the gum solution will keep for months.

The selection of the pigments is not such a serious matter as some of the writers would lead us to believe. Tube water colors are convenient and save the trouble of grinding, but the cheap colors in powder take a better grip and give richer images. The best prints are made with mixtures of common lampblack, red ocher, sienna, umber, and Vandyke brown, the only objection to their employment being the necessity of rather carefully grinding. This may be done with a stiffish spatula and a sheet of finely ground glass, the powder mixed with a little gum solution and rubbed with the spatula till smooth, but better still is a glass paper weight in the shape of a cone with a base of about 1½ inches in diameter, bought in the stationer's for 25 cents.

The sensitizer is a 10 per cent solution of potassium bichromate, and whatever be the pigment or whatever the method of preparing the coating, it may be useful to keep in mind that the right strength or proportion, or at least a strength of coating that answers very well, is equal parts of that and the gum solution.

In preparing the coating measure the gum solution in a cup from a toy tea set that holds exactly 1 ounce, it being easier to get it all out of this than out of a conical graduate. From 20 to 30 grains of the color or mixture of colors in powder is placed on the slab—the ground surface of an "opal" answers well—and enough of the gum added to moisten it, and work the paper weight "muller," aided by the

spatula, as long as any grittiness remains, or till it is perfectly smooth, adding more and more gum till it is like a thick cream. It is then transferred to a squat teacup and 1 ounce of the bichromate solution gradually added, working it in with one of the brushes to perfect homogeneity. Of course, it will be understood that this mixture should be used all at once, or rather only as much as is to be used at once should be made, as notwithstanding what has been said to the contrary, it will not keep. After each operation, both or all of the brushes should be thoroughly cleaned before putting them away.

Not the least important are the brushes; one about 2 inches wide and soft for laying on the coating, the other, unless for small work, twice that breadth and of what is known as "badger" or a good imitation thereof, for softening.

The paper can be bought in sheets of about 17 x 22 inches. Cut these in two, coating pieces of about 17 x 11. The sheet is fastened to a drawing board by drawing pins, one at each corner. The coating brush—of camel's hair, but it is said that hog's is better—is filled with the creamy mixture, which has been transferred to a saucer as more convenient, and with even strokes, first one way and then the other, drawn all over the paper. It is easier to do than to describe, but all three joints, wrist, elbow, and shoulder take part, and unless the surface of the paper is too smooth, there is really no difficulty to speak of.

By the time the whole surface has been covered the paper will have expanded to an extent that makes it necessary to remove three of the pins and tighten it, and then comes the most important and the only really difficult part of the work, the softening. The softener is held exactly as one holds the pen in writing, and the motion confined altogether to the wrist, bringing only the points of the hair in contact with the coating, more like stippling than painting.

If much of the coating has been laid on, and too much is less of an evil than too little, the softener will soon have taken up so much as to require washing. This is done at the tap, drying on a soft cloth, and repeat the operation, the strokes or touches gradually becoming lighter and lighter, till the surface is as smooth and free from markings as if it had been floated.

Just how thick the coating should be is most easily learned by experience, but as, unlike ordinary carbon, development begins from the exposed surface, it must be as deep; that is, as dark on the paper as the deepest shadow on the intended print, and it should not be deeper.

While it is true that the bichromate colloid is not sensitive while wet, the coating is best done in subdued light, indeed, generally at night. Hang the sheets to dry in the dark room.

Exposure should be made with some form of actino-meter.

Development may be conducted in various ways, and is modified according to the extent of the exposure. Float the exposed sheet on water at the ordinary temperature from the tap. The exposure should admit of complete, or nearly complete, development in that position in from 5 to 10 minutes; although it should not generally be allowed to go so far. By turning up a corner from time to time one may see how it goes, and at the suitable stage depending on what one really wants to do, the otherwise plain outcome of the negative is modified, gently withdrawn from the water, and pinned up to dry.

The modifying operation may be done at once, where the exposure has been long enough to admit it, but generally, and especially when it has been such as to admit of the best result, the image is too soft, too easily washed off to make it safe. But after having been dried and again moistened by immersion in water, the desired modification may be made with safety.

The moistened print is now placed on a sheet of glass, the lower end of which rests on the bottom of the developing tray, and supported by the left hand at a suitable angle; or, better still, in some other way so as to leave both hands free. In this position, and with water at various temperatures, camel's-hair brushes of various sizes, and a rubber syringe, it is possible to do practically anything.

TABLES AND SCALES:

Comparative Exposures of Various Subjects.—

	Seconds
Open panorama, with fields and trees	1
Snow, ice, marine views	1
Panorama, with houses, etc.	2
Banks of rivers	3
Groups and portraits in open air (diffused light)	6
Underneath open trees	6
Groups under cover	10
Beneath dense trees	10
Ravines, excavations	10
Portraits in light interiors	10
Portraits taken 4 feet from a window, indoors, diffused light	30

TABLE SHOWING DISPLACEMENT ON GROUND GLASS OF OBJECTS IN MOTION

By Henry L. Tolman

From the Photographic Times

Lens 6-inch Equivalent Focus, Ground Glass at Principal Focus of Lens

Miles per Hour.	Feet per Second.	Distance on Ground Glass, in inches, with Object 30 Feet away.	Same with Object 60 Feet away.	Same with Object 120 Feet away.
1	1½	.29	.15	.073
2	3	.59	.29	.147
3	4½	.88	.41	.220
4	6	1.17	.59	.293
5	7½	1.47	.73	.367
6	9	1.76	.88	.440
7	10½	2.05	1.03	.513
8	12	2.35	1.17	.587
9	13	2.64	1.32	.660
10	14½	2.93	1.47	.733
11	16	3.23	1.61	.807
12	17½	3.52	1.76	.880
13	19	3.81	1.91	.953
14	20½	4.11	2.05	1.027
15	22	4.40	2.20	1.100
20	29	5.87	2.93	1.467
25	37	7.33	3.67	1.833
30	44	8.80	4.40	2.200
35	51	10.27	5.13	2.567
40	59	11.73	5.97	2.933

W. D. Kilbey, in the *American Annual of Photography*, gives still another table for the exposure that should be given to objects in motion.

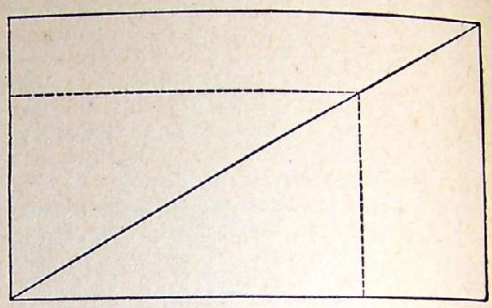
According to his method the table is made out for a distance from the camera 100 times that of the focus of the lens; that is, for a 6-inch focus lens at 50 feet, a 7-inch at 58 feet, an 8-inch at 67 feet, a 9-inch at 75 feet, or a 12-inch at 100 feet.

	Toward the Camera.	At Right Angles to the Camera.
Man walking slowly, street scenes	1/15 sec.	1/45 sec.
Cattle grazing	1/15 "	1/45 "
Boating	1/20 "	1/60 "
Man walking, children playing, etc.	1/40 "	1/120 "
Pony and trap, trotting	1/100 "	1/300 "
Cycling, ordinary	1/100 "	1/300 "
Man running a race and jumping	1/150 "	1/450 "
Cycle racing	1/200 "	1/600 "
Horses galloping	1/200 "	1/600 "

If the object is twice the distance, the length of allowable exposure is doubled, and vice versa.

To Reduce Photographs.—When one wishes to copy a drawing or photograph he is usually at a loss to know how high the plate will be when any particular base is selected. A plan which has the merit of being simple and reliable has been in use in engravers' offices for years.

Here are the details:



Reducing Scale for Copying Photographs.

Turn the drawing face down and rule a diagonal line from the left bottom to the right top corner. Then measure from the left, on the bottom line, the width required. Rule a vertical line from that point until it meets the diagonal. Rule from that point to the left, and the resulting figure will have the exact proportions of the reduction. If the depth wanted is known, and the width is required, the former should be measured on the left upright line, carried to the diagonal, and thence to the lower horizon. The accompanying diagram explains the matter simply.

COLOR PHOTOGRAPHY:

A Three-Color Process.—Prepare 7 solutions, 4 of which are used for color screens, the remaining 3 serving as dyes for the plates.

A.—Screen Solutions.—

Blue violet.	By weight
Methylene blue	5 parts
Tetraethyldiamido-oxytriphenyl carbinol	2 parts

Or:

	By weight
Methyl violet	5 parts
Alcohol	200 parts
Water, distilled	300 parts

Green.	By weight
Malachite green	10 parts
Alcohol	200 parts
Water, distilled	300 parts

Yellow.	By weight
Acridin yellow N. O.	10 parts
Alcohol	200 parts
Water, distilled	300 parts

Red.	By weight
Congo rubin	10 parts
Alcohol	200 parts
Water, distilled	300 parts

B.—Dyes (Stock Solutions).—

I.—Acridin yellow or acridin orange, N. O.	By weight 1 part
Alcohol	100 parts
Water, distilled	400 parts

II.—Congo rubin	By weight 1 part
Alcohol	100 parts
Water, distilled	400 parts

III.— Tetraethyldiamido-oxytriphenyl carbinol	By weight 1 part
Alcohol	100 parts
Water, distilled	400 parts

The screen solutions, after being filtered through paper filters into clean dishes, are utilized to bathe 6 clean glass plates previously coated with 2 per cent raw collodion; we require 1 plate for blue violet, 2 plates for red, 2 plates for yellow, and 1 plate for green, which in order to obtain the screens are combined in the following way: Yellow and red plate, yellow and green plate. For special purposes the other red plate may be combined with the blue violet. Another method of preparing the screens is to add the saturated solutions drop by drop to a mixture of Canada balsam and 2 per cent castor oil and cement the glasses together. Those who consider the screens by the first method too transparent, coat the glass plates with a mixture of 2 to 3 per cent raw collodion and 1 per cent color solution. Others prefer gelatin screens, using

	By weight
Hard gelatin (Nelson's)	8 parts
Water	100 parts
Absolute alcohol	10 parts
Pigment	1 part

This is poured over the carefully leveled and heated plate after having been filtered through flannel.

The collodion screens are cemented together by moistening the edges with Canada balsam (containing castor oil) and pressing the plates together in a printing frame, sometimes also binding the edges with strips of Japanese paper.

On the evening before the day of work, good dry plates of about 18° to 24° W. are dyed in the following solution:

	By weight
Stock solution, No. 1	16 parts
Distilled water	100 parts
Alcohol	5 parts
Nitrate of silver (1.500)	50 parts
Ammonia	1–2 parts

This bath sensitizes almost uninterruptedly to line A. The total sensitiveness is high, and the plate develops cleanly and fine. Blue sensitiveness is very much reduced, and the blue screen is used for exposure. As far as the author's recollection goes, the plate for the yellow color has never been color-sensitized, many operators using the commercial Vogel-Obernetter eosin silver plates made by Perutz, of Munich; others again only use ordinary dry plates with a blue-violet screen. This is, however, a decided mistake, necessitating an immense amount of retouching, as otherwise it produces a green shade on differently colored objects of the print.

For the red color plate the dry plate is dyed in

	By weight
Stock solution, No. 2	10 parts
Distilled water	100 parts
Nitrate of silver (1.500)	100 parts
Ammonia	2 parts

The resulting absorption band is closed until E, reaching from violet to red (over C). This red pigment was examined by Eder, who obtained very good results, using ammonia in the solution.

The corresponding screen is a combination of malachite green with acridin yellow or acridin orange N. O.

For the blue color plate the dye is made up as follows:

	By weight
Stock solution, No. 3	0.5–1 part
Distilled water	100 parts
Nitrate of silver (1.500)	100 parts
Ammonia	1–2 parts

This dye yields a strong band, commencing at B, reaching to C ¾ D; since the orange screen used herewith necessitates a long exposure, the action seems to extend into the infra-red (beyond A).

As a rule, cyanine is used instead of the tetraethyldiamidooxytriphenyl car-

binol (HCl salt), but the former is apt to produce fogged plates. Methyl violet or crystal violet has also been suggested.

Exposures should be made in direct sunlight or with artificial pure white light (acetylene); electric light is too variable.

The most suitable methods of reproduction are half-tone, and the prototype methods; also Turati's Isotypie. The greatest difficulty in 3-color printing nowadays is presented by the want of accurate printing. We must use the proper paper and pure fast colors; the inking rollers should be smooth, not too soft, and free from pores or weals. The blocks must be firmly fixed typehigh, otherwise they take color irregularly. A good printing machine is, of course, most essential.

To supplement the above working directions: After having kept the plates for 2 or 3 minutes (constantly moving the dish) in the dyes, they are removed into a dish containing filtered alcohol, which extracts the superfluous pigment. Plates thus treated dry much more rapidly, develop cleaner, and show no fogging.

Most of the above dyes may be obtained from the "Berliner Actiengesellschaft für Anilinfabrikation," the acridin only from the "Farbwerk Mühlheim, a/Main, vorm. A. Leonhard & Company."

Solution for Preparing Color Sensitive Plates.—H. Vollenbruch maintains that plates sensitized with erythrosin silver citrate are not only more sensitive to color impressions, but also have better keeping qualities than ordinary erythrosin bathed plates.

For depression of the over-active blue rays he recommends the addition of picric acid to the coloring solution. The picric acid erythrosin silver citrate ammonia solution is prepared as follows:

Solution I

Citrate of potassa 1 gram
Distilled water.. 10 cubic centimeters

Solution II

Silver nitrate.... 1 gram
Distilled water.. 10 cubic centimeters

Both solutions are mixed and a white precipitate is formed which is allowed to subside. The clear supernatant liquid is poured off carefully, precipitate washed with water, allowed again to subside, and the wash water again decanted. This process is repeated two or three times. Finally a large bulk of water (20 cubic centimeters) is added to the precipitate and well shaken; 5 cubic centimeters of this is reserved, the remainder is treated to ammonia, drop by drop, until the precipitate is redissolved. Now add the 5 cubic centimeters of reserved solution and shake the whole until every particle is dissolved. Then make up the solution to 50 cubic centimeters and filter; this forms Solution III.

Solution IV

Distilled water.. 300 cubic centimeters
Pure erythrosin.. 1 grain

Under lamplight the 50 cubic centimeters of Solution III are poured slowly with repeated shaking in Solution IV, by which the originally beautiful red is converted into a dirty turbid bluish red somewhat viscid fluid; add—

Solution V

Picric acid..... 4 grams
Absolute alcohol. 30 cubic centimeters

Shake well, and add to the whole 33 cubic centimeters ammonia (specific gravity, 0.91), wherewith the beautiful red color is restored.

After the filtration call this Solution VI. This solution keeps well. The slight deposit formed is redissolved on shaking.

The plates are sensitized as follows: The plate to be sensitized is first laid in a tray of distilled water for 2 or 3 minutes, then bathed in a mixture of 1 cubic centimeter ammonia for 1 minute and finally for 2 minutes in a bath composed of the following:

Color Solution VI 10 cubic centimeters
Distilled water... 300 cubic centimeters

The plate is well drained and dried in a perfectly dark room. These plates keep well for several months.

MICROPHOTOGRAPHS.

The instruments used are an objective of very short focus and a small camera with a movable holder. This camera and the original negative to be reduced are fastened to the opposite ends of a long, heavy board, similar to the arrangement in use for the making of lantern slides. The camera must be movable in the direction of the objective axis, and the negative must be fastened to a vertically stationary stand. It is then uniformly lighted from the reversed side by either daylight or artificial light. Some difficulty is experienced in getting a sharp focus of the picture. The ordinary ground glass cannot be used, not

being fine enough, and the best medium for this purpose is a perfectly plain piece of glass, coated with pretty strongly iodized collodion, and sensitized in the silver bath, the same way as in the wet process. The focusing is done with a small lens or even with a microscope. The plate intended for the picture has, of course, to lie in exactly the same plane as the plate used for focusing. To be certain on this point, it is best to focus upon the picture plate, inserting for this purpose a yellow glass between objective and plate. If satisfactory sharpness has been obtained, the apparatus is once for all in order for these distances. Bromide of silver gelatin plates, on account of their comparatively coarse grain, are not suitable for these small pictures, and the collodion process has to come to the rescue.

Dagron, in Paris, a prominent specialist in this branch, gives the following directions: A glass plate is well rubbed on both sides with a mixture of 1,000 parts of water, 50 parts powdered chalk, and 200 parts of alcohol, applied with a cotton tuft, after which it is gone over with a dry cotton tuft, and thereafter cleaned with a fine chamois leather. The side used for taking the picture is then finally cleaned with old collodion. The collodion must be a little thinner than ordinarily used for wet plates. Dissolve

Ether	400 parts
Alcohol	100 parts
Collodion cotton	3 parts
Iodide ammonia	4 parts
Bromide ammonia	1 part

The plate coated herewith is silvered in a silver bath of 7 or 8 per cent. From 12 to 15 seconds are sufficient for this.

The plate is then washed in a tray or under a faucet with distilled water, to liberate it from the free nitrate of silver and is afterwards placed upon blotting paper to drip off. The still moist plate is then coated with the albumen mixture:

Albumen..... 150 cubic centimeters

Add

Water	15 cubic centimeters
Iodide potassium	3 grams
Ammonia	5 grams
White sugar	2 grams

Iodine, a small cake.

With a wooden quirl this is beaten to snow (foam) for about 10 minutes, after which it must stand for 14 hours to settle. The albumen is poured on to the plate the same as collodion, and the surplus filtered back. After drying, the plate is laid for 15 seconds in a silver bath, consisting of 100 parts of water, 10 parts nitrate of silver, and 10 cubic centimeters of acetic acid. The plate is then carefully washed and left to dry. If carefully kept, it will retain its properties for years. To the second silver bath, when it assumes a dirty coloration, is added 25 parts kaolin to each 100 parts, by shaking the same well, and the bath is then filtered, after which a little nitrate of silver and acetic acid is added.

After each exposure the plate holder is moved a certain length, so that 10 or more reproductions are obtained upon one and the same plate. The time of exposure depends upon the density of the negative and differs according to light. It varies between a second and a minute.

The developer is composed as follows:

Water	100 parts
Gallic acid	0.3 parts
Pyro	0.1 part
Alcohol	2.5 parts

The exposed plate is immersed in this bath, and after 10 to 20 seconds, from 1 to 2 drops of a 2 per cent nitrate of silver solution are added to each 100 cubic centimeters of the solution, whereby the picture becomes visible. To follow the process exactly, the plate has to be laid—in yellow light—under a weakly enlarging microscope, and only a few drops of the developer are put upon the same. As soon as the picture has reached the desired strength, it is rinsed and fixed in a fixing soda solution, 1 to 5. Ten to 15 seconds are sufficient generally. Finally it is washed well.

After the drying of the plate, the several small pictures are cut with a diamond and fastened to the small enlarging lenses. For this purpose, the latter are laid upon a metal plate heated from underneath, a drop of Canada balsam is put to one end of the same, and, after it has become soft, the small diapositive is taken up with a pair of fine pincers, and is gradually put in contact with the fastener. Both glasses are then allowed to lie until the fastener has become hard. If bubbles appear, the whole method of fastening the picture has to be repeated.

Photographs on Brooches.—These may be produced by means of a paper (celuidin paper) whose upper layer after exposure by means of ordinary negative can be detached in lukewarm water. The picture copied on this paper is first laid in tepid water. After a few minutes it is taken out and placed on the article in question, naturally with the face upon it. The enamel surface upon which the pic-

ture is laid is previously coated with gelatin solution to insure a safe adhesion. When dry, the article is placed in water in which the paper is loosened and the photographic image now adheres firmly to the object. It may now be colored further and finally is coated with a good varnish.

FLASHLIGHT POWDERS AND APPARATUS.

Flash powders to be ignited by simply applying the flame of a match or laying on an oiled paper and igniting that, may be made by the following formulas:

I.—Magnesium.....	6 parts
Potassium chlorate..	12 parts
II.—Aluminum.....	4 parts
Potassium chlorate..	10 parts
Sugar.....	1 part

The ingredients in each case are to be powdered separately, and then lightly mixed with a wooden spatula, as the compound may be ignited by friction and burn with explosive violence.

It is best to make only such quantity as may be needed for use at the time, which is 10 or 15 grains.

To Prevent Smoke from Flashlight.—Support over the point where the ignition is to take place a large flat pad of damp wool lint. This may be done by tacking the lint to the underside of a board supported on legs. When ignition takes place the products of combustion for the most part will become absorbed by the wool.

A Flashlight Apparatus with Smoke Trap.—A light box, not too large to be conveniently carried out into the open air, is the first essential, and to the open front of this grooves must be fitted, in which grooves a lid will slide very easily, a large sheet of millboard being convenient as a sliding lid. The box being so placed that the sliding lid can be drawn out upward, a thread is attached to the lower edge of the lid, after which the thread is passed over a pulley fixed inside the box near the top, when the end is attached to the bottom of the box, so that the thread holds the sliding lid up. The lid will then slide down the grooves quickly, and close the box, if the thread is severed, the thread being cut at the right instant by placing the lower part across the spot where the flash is to be produced. So small is the cloud of smoke at the first instant that practically the whole of it can be caught in a drop trap of the above-mentioned kind. If the apparatus is not required again for immediate use, the smoke may be allowed to settle down in the box; but in other cases the box may be taken out into the open air, and the smoke buffeted out with a cloth. In the event of several exposures being required in immediate succession, the required number of apparatus might be set up, as each need not cost much to construct.

INTENSIFIERS AND REDUCERS:

Intensifier (Mercuric) with Sodium Sulphite, for Gelatin Dry Plates.—Whiten the negative in the saturated solution of mercuric chloride, wash and blacken with a solution of sulphite of sodium, 1 in 5. Wash well.

The reduction is perfect, with a positive black tone.

Intensifier with Iodide of Mercury.—Dissolve 1 drachm of bichloride of mercury in 7 ounces of water and 3 drachms of iodide of potassium in 3 ounces of water, and pour the iodide solution into the mercury till the red precipitate formed is completely dissolved.

For use, dilute with water, flow over the negative till the proper density is reached, and wash, when the deposit will turn yellow. Remove the yellow color by flowing a 5 per cent solution of hypo over the plate, and give it the final washing.

Agfa Intensifier.—One part of agfa solution in 9 parts water (10 per cent solution). Immerse negative from 4 to 6 minutes.

Intensifying Negatives Without Mercury.—Dissolve 1 part of iodine and 2 parts of potassium iodide in 10 parts of water. When required for use, dilute 1 part of this solution with 100 parts of water. Wash the negative well and place in this bath, allowing it to remain until it has become entirely yellow, and the image appears purely dark yellow on a light-yellow ground. The negative should then be washed in water until the latter runs off clearly, when it is floated with the following solution until the whole of the image has become uniformly brown:

Schlippe's salt.....	60 grains
Water.....	1 ounce
Caustic soda solution, 10 per cent.....	6 drops

Finally the negative is again thoroughly washed and dried. The addition of the small quantity of caustic soda is to prevent surface crystallization. It is claimed that with this intensifier the operation may be carried out to a greater

extent than with bichloride of mercury; that it gives clear shadows, and that it possesses the special advantage of removing entirely any yellow stain the negative may have acquired during development and fixing. Furthermore, with this intensifying method it is not necessary to wash the negative, even after fixing, as carefully as in the case of the intensifying processes with mercury, because small traces of hypo which may have been left in the film will be rendered innocuous by the free iodine. The iodine solution may be employed repeatedly if its strength is kept up by the addition of concentrated stock solution.

Uranium Intensifier.—

Potassium ferricyanide (washed)	48 grains
Uranium nitrate	48 grains
Sodium acetate	48 grains
Glacial acetic acid	1 ounce
Distilled water to	10 ounces.

Label: Poison. Immerse the well-washed negative till the desired intensification is reached, rinse for 5 minutes and dry. This intensifier acts very strongly and should not therefore be allowed to act too long.

MISCELLANEOUS FORMULAS:

Renovating a Camera.—The following formula should be applied to the mahogany of the camera by means of a soft rag, rubbing it well in, finally polishing lightly with a clean soft cloth:

Raw linseed oil	6 ounces
White wine vinegar	3 ounces
Methylated spirit	3 ounces
Butter of antimony	½ ounce

Mix the oil with vinegar by degrees, shaking well to prevent separation after each addition, then add the spirit and antimony, and mix thoroughly. Shake before using.

Exclusion of Air from Solutions.—Water is free from air only when it has been maintained for several minutes in bubbling ebullition. In order to keep out the air from the bottle, when using the contents, the air-pressure contrivances are very convenient; one glass tube reaching through the rubber stopper into the bottle to the bottom, while the second tube, provided with a rubber pressing-ball, only runs into the flask above. If the long bent tube is fitted with a rubber tube, a single pressure suffices to draw off the desired quantity of the developer. It is still more convenient to pour a thin layer of good sweet oil on top of the developer besides. The developer is not injured thereby, and the exclusion of air is perfect.

Bottle Wax.—Many ready-prepared solutions, such as developers and other preparations from which light has to be excluded, should be packed in bottles whose neck, after complete drying of the stopper, is dipped in a pot with molten sealing wax. A good recipe is the following, pigments being added if desired: For black take: Colophony, 6 parts; paraffine, 3 parts. Melt together and add 20 parts of black. For yellow, only 7 parts of chrome yellow. For blue, 7 parts of ultramarine.

Bleaching Photographic Prints White.—To make a salt print, ink over it with waterproof ink, then bleach out white all but the black lines. Sensitize Clemon's mat surface paper on a 40-grain bath of nitrate of silver. After fuming and printing, the print is thoroughly fixed in hyposulphite of soda solution, and washed in running water until every trace of the hypo is out of the print. On this the permanency of the bleaching operation depends. The bleaching bath is:

Bichloride of mercury	1 ounce
Water	5 ounces
Alcohol	1 ounce
Hydrochloric acid	1 drachm

If the drawing has been made with non-waterproof ink, then alcohol is substituted for the water in the formula. For safety, use an alcoholic solution of mercury. The bleaching solution is poured on and off the drawing, and, when the print is bleached white, the mercury is washed off the drawing by holding it for a few moments under running water. Photographs bleached in this way will keep white for years.

To Render Negatives Permanent.—A fine negative, one that we would like to preserve, may be rendered permanent by placing it, after it has been fixed, in a 10 per cent solution of alum, and letting it remain a few minutes. This makes the plate wonderfully clear and clean, and absolutely unalterable. The alum acts upon the gelatin, rendering it insoluble.

Stripping Photograph Films.—This is generally done by immersing the plate in formaldehyde solution until the film has become almost insoluble and impermeable. Then it is placed in a solution of sodium carbonate until the gelatin has absorbed a sufficient quantity of it. When the negative is immersed in weak hydrochloric acid, carbon di-

oxide is liberated, and the little bubbles of gas which lodge themselves between the film and the glass cause a separation of the two, so that the film may be stripped off. After having hardened the film with formaldehyde, it is a lengthy process to get it saturated with sodium carbonate. It is advisable to use a combined bath of 1 part of carbonate, 3 of 40 per cent formaldehyde, and 20 of water; its tanning action is enhanced by the alkaline reaction, and two operations are superseded by one. After 10 minutes' soaking, the surface of the film must be wiped and the plate dried. A sharp knife is then used to cut all around the film a slight distance from the edge, and when this is done the negative is put into a 5 per cent solution of hydrochloric acid, when the film will probably float off unaided; but, if necessary, may be assisted by gently raising one corner.

Phosphorescent Photographs. — The necessary chemicals belong to the class of phosphorescent bodies, among others, calcium sulphite, strontium sulphite, barium sulphide, calcareous spar, fluorspar. These placed in the magnesium light or sunlight, acquire the property of giving forth, for a shorter or longer time, a light of their own. The best examples of these substances are the well-known "Balmains light colors," which yield a very clear and strong light after exposure. They consist of calcium sulphide, 10,000 parts; bismuth oxide, 13 parts; sodium hyposulphite, 1,000 parts.

According to Professor Schnauss, plates for phosphorographs are prepared as follows: Dissolve 10 parts of pure gelatin in 50 parts of hot water, add and dissolve 30 parts of "light" color (as above), and 1 part of glycerine.

If a plate or a paper, prepared as above detailed, be placed under a diapositive, in a copying apparatus, and submitted to the action of sunlight for a few minutes, when taken out in a dark room a phosphorescent picture of the diapositive will be found. It is also a known fact that duplicate negatives or positives may be made with this phosphorograph by simply bringing the latter in contact in a copying apparatus, with the ordinary silver bromide plate for 30 seconds, in the dark room, and then developing the same.

Printing Names on Photographs.— The name or other matter to be printed on the photograph is set up in type, and printed on cardboard; from this make an exposure on a transparency plate, developing it strongly. After the print has been made from the regular printing negative, it is placed under the dense transparency of the regular negative, and the name printed in. The only precaution necessary is to time the transparency negative properly, and develop strongly, so as to get good contrast. Photographers will find this a much easier and quicker method than the old one of printing on tissue paper and fastening the paper to the negative by means of varnish; moreover, the result is black instead of white, usually much more pleasing.

Spots on Photographic Plates.—Spots on photographic plates may be caused by dust or by minute bubbles in the emulsion, both of which are easily preventable, but some spots cannot be ascribed to either of these causes. On investigating this trouble, Mumford found that it is due to the presence on the surface of the film of small colonies of microorganisms which, under conditions favorable to their growth, are capable of producing large mold colonies, from which the organisms can easily be separated. Experiments were instituted in order to find whether these growths can be produced on the plate by artificial means, by inoculating the surface with a fluid culture of one of these organisms, with affirmative results, but with one slight difference, namely, that in the inoculated film, on microscopic examination, no dust particle was visible in the center of each spot, which had formerly been the case. As these microorganisms do not exist in the air as isolated units, but travel upon small or large dust particles in the case under consideration, the carrying medium most probably is the fine impalpable dust from which it is practically impossible to free the air of a building. In order that these organisms may grow into colonies of sufficient size to cause spots, they must be able to grow rapidly, there being only about 12 hours before the plate is dry in which they can grow; and they must also be capable of growing at the rather high temperature of 70° F. On testing some of the organisms causing the spots it was found that they grew best under exactly such conditions. A bacteriological examination of some of the gelatin used in the manufacture of plates, both in the raw state and in the form of emulsion, also revealed the fact that there were numerous organisms present. No means for the prevention of this troublesome defect is suggested:

most dry-plate manufacturers use the precaution to add a small quantity of a chemical antiseptic to the emulsion, but it is not possible to employ a sufficient quantity to destroy any organisms that may be present without damaging the plate for photographic purposes.

To Remove Pyro Stains from the Fingers.—Make a strong solution of chlorinated lime; dip the fingers which are stained in this, and rub the stains with a large crystal of citric acid. Apply the lime solution and acid alternately until the stain is removed; then rinse with water.

To Remove Pyro Stain from Negatives.—Immerse in a clearing bath as follows:

Protosulphate of iron.	3 ounces
Alum	1 ounce
Citric acid	1 ounce
Water	20 ounces

Prevention is better than cure, however; therefore immerse the negatives in the above directly they are taken from the fixing bath. After clearing the negatives, they should be well washed.

Process of Transferring Photos to Watch Cases and Dials.— Flow the photo with the solution as made below, let dry ten or fifteen minutes, then paste down on a piece of clean window glass using an ordinary paste. Let dry for an hour or dry more quickly over a lamp. Then with your finger, rub the back of the picture from the center outward, using plenty of cold water. When paper is all off, lay the glass in hot water and the composition will lift from the glass. Put it on a piece of common paper cut to the size desired and throw the circle back in the water and the impression will float from the paper. Then cover the case or dial with a solution of Acacia and stick the picture in the case with a silk handkerchief and the work is done.

Solution for flowing over photo:

Ethyl Chloride or Sulphuric Ether	1 drachm
Collodion	1 ounce
Venice Turpentine	about 6 drops

A little less turpentine will be best to start with and add more if the film does not turn white quickly when working. Follow the directions carefully.

Pigments

(See also Paints.)

Nature, Source, and Manufacture of Pigments.—A pigment is a dry earthy or clayey substance that, when mixed with oil, water, etc., forms a paint. Most pigments are of mineral origin, but there are vegetable pigments, as logwood, and animal pigments, as cochineal. In modern practice the colors are produced mainly by dyeing certain clays, which excel in a large percentage of silicic acid, with aniline dyestuffs. The coloring matters best adapted for this purpose are those of a basic character. The colors obtained in this manner excel in a vivid hue, and fastness to light and water.

Following is a general outline of their manufacture: One hundred parts, by weight, of washed clay in paste form are finely suspended in 6 to 8 times the volume of water and acidulated with about 1½ parts, by volume, of 5 per cent hydrochloric or acetic acid, and heated by means of steam almost to the boiling temperature. There is next introduced, according to the shade desired, 1 to 2 parts, by weight, of the dyestuff, such as auramin, diamond green, Victoria blue, etc., with simultaneous stirring and heating, for 1 to 2 hours, or until a sample filtered off from the liquor shows no dyestuff. Next the clay dyed in this manner is isolated by filtration and washed with hot water and dried. The colors thus obtained may be used as substitutes for mineral colors of all description.

The method of manufacture varies greatly. According to the Bennett and Mastin English patent the procedure is as follows: Grind together to a paste in water, substances of a clayey, stony, earthy, or vitreous nature, and certain metallic oxides, or "prepared oxides," such as are commonly used in the pottery trades; dry and powder the paste, and subject the powder to the heat of a furnace, of such a temperature that the requisite color is obtained, and for such length of time that the color strikes through the whole substance. For example, 8 parts of black oxide of cobalt, 12 parts of oxide of zinc, and 36 parts of alumina, when incorporated with 20 times their combined bulk of clay and treated as described, yield a rich blue pigment in the case of a white clay, and a rich green in the case of a yellow clay. Long-continued firing in this case improves the color.

Many minerals included in formulas for pigments have little or no coloring power in themselves; nevertheless they